

# NAVAL POSTGRADUATE SCHOOL

## Monterey, California



### THESIS

**SEALIFT TRANSPORTATION IN A WORKING  
CAPITAL FUND ENVIRONMENT:  
RATE STABILITY WHEN WORKLOAD DECLINES**

by

Angela H. Hively

March 1999

Thesis Advisor:  
Associate Advisor:

Ira A. Lewis  
Theodore A. Hleba

Approved for public release; distribution is unlimited.

19990512 035

| REPORT DOCUMENTATION PAGE   |  |   | Form Approved<br>OMB No. 0704-0188 |   |
|---|--|---|------------------------------------|---|
| Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instruction, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188) Washington DC 20503. |  |   |                                    |   |
| 1. AGENCY USE ONLY (Leave blank)  |  | 2. REPORT DATE<br>March 1999                            |                                    | 3. REPORT TYPE AND DATES COVERED<br>Master's Thesis |
| 4. TITLE AND SUBTITLE : SEALIFT TRANSPORTATION IN A WORKING CAPITAL FUND ENVIRONMENT: RATE STABILITY WHEN WORKLOAD DECLINES   |  |   |                                    | 5. FUNDING NUMBERS                                  |
| 6. AUTHOR(S)<br>Hively, Angela H.   |  |   |                                    |   |
| 7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)<br>Naval Postgraduate School<br>Monterey, CA 93943-5000  |  |   |                                    | 8. PERFORMING ORGANIZATION REPORT NUMBER            |
| 9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES)   |  |   |                                    | 10. SPONSORING / MONITORING AGENCY REPORT NUMBER    |
| 11. SUPPLEMENTARY NOTES<br>The views expressed in this thesis are those of the author and do not reflect the official policy or position of the Department of Defense or the U.S. Government.   |  |   |                                    |   |
| 12a. DISTRIBUTION / AVAILABILITY STATEMENT<br>Approved for public release; distribution is unlimited.   |  |   |                                    | 12b. DISTRIBUTION CODE                              |
| 13. ABSTRACT (maximum 200 words)<br><br>This research presents statistical analysis of rates and volume for Military Sealift Command point-to-point ocean transportation billing rates, with conclusions about the stability and flexibility of the Working Capital Fund system in the ocean transportation context. The analysis tests the statistical validity of the assumption that rates increase when volume declines.  |  |   |                                    |   |
| 14. SUBJECT TERMS<br>Sealift, Shipping, Transportation, Working Capital Fund  |  |   |                                    | 15. NUMBER OF PAGES<br>64                           |
|   |  |   |                                    | 16. PRICE CODE                                      |
| 17. SECURITY CLASSIFICATION OF REPORT<br>Unclassified   | 18. SECURITY CLASSIFICATION OF THIS PAGE<br>Unclassified | 19. SECURITY CLASSIFICATION OF ABSTRACT<br>Unclassified |                                    | 20. LIMITATION OF ABSTRACT<br>UL                    |

NSN 7540-01-280-5500

Standard Form 298 (Rev. 2-89)  
Prescribed by ANSI Std. Z39-18



Approved for public release; distribution is unlimited.

**SEALIFT TRANSPORTATION IN A WORKING CAPITAL FUND  
ENVIRONMENT:  
RATE STABILITY WHEN WORKLOAD DECLINES**

Angela H. Hively  
Lieutenant, United States Navy  
B.A., University of Texas at Austin, 1991

Submitted in partial fulfillment of the  
requirements for the degree of

**MASTER OF SCIENCE IN MANAGEMENT**

from the

**NAVAL POSTGRADUATE SCHOOL  
March 1999**

Author: Angela Hively  
Angela H. Hively

Approved by: Ira A. Lewis  
Ira A. Lewis, Thesis Advisor

Theodore A. Hleba  
Theodore A. Hleba, Associate Advisor

Reuben T. Harris  
Reuben T. Harris, Chairman  
Department of Systems Management



## **ABSTRACT**

This research presents statistical analysis of rates and volume for Military Sealift Command point-to-point ocean transportation billing rates, with conclusions about the stability and flexibility of the Working Capital Fund system in the ocean transportation context. The analysis tests the statistical validity of the assumption that rates increase when volume declines.



## TABLE OF CONTENTS

|      |   |    |
|------|---|----|
| I.   | INTRODUCTION .....  | 1  |
| A.   | PURPOSE .....   | 1  |
| B.   | BACKGROUND .....  | 1  |
| C.   | SCOPE AND METHODOLOGY .....                                       | 2  |
| D.   | ORGANIZATION OF THESIS .....                                      | 3  |
| II.  | RELATIONSHIPS WITHIN THE TRANSPORTATION SYSTEM .....              | 5  |
| A.   | DEFINING SEALIFT .....  | 5  |
| B.   | ASSIGNMENT POLICY FOR COMMERCIAL VICE ORGANIC<br>LIFT .....       | 6  |
| 1.   | Customer Relationships .....                                      | 6  |
| 2.   | Ownership of Assets .....   | 7  |
| III. | WORKING CAPITAL FUNDS AND SEALIFT TRANSPORTATION<br>RATES .....   | 9  |
| A.   | PURPOSE AND HISTORY .....   | 11 |
| B.   | WORKING CAPITAL FUNDS AS THEY APPLY TO MSC .....                  | 14 |
| C.   | DEFINING "COMMON-USER"—THE PROBLEM OF<br>DISTRIBUTING COSTS ..... | 15 |
| 1.   | Sponsorship .....   | 15 |
| 2.   | The Process of Assigning Lift .....                               | 16 |
| D.   | HISTORICAL BILLING RATES .....                                    | 17 |
| 1.   | Route Classifications .....                                       | 18 |
| 2.   | Commodity Classifications .....                                   | 18 |
| 3.   | Historical Rates for Special Cargo .....                          | 20 |
| 4.   | Applying a Rate with Mileage Figured In .....                     | 20 |
| E.   | UNIT COST AND NET OPERATING RESULT .....                          | 22 |
| 1.   | Billing Methods and Unit Costs .....                              | 22 |
| 2.   | Adjusting Rates for Net Operating Result .....                    | 26 |



|   |    |
|---|----|
| F. FIXED AND VARIABLE COSTS .....                         | 29 |
| IV. STATISTICAL ANALYSIS OF RATES AND VOLUME .....        | 31 |
| A. VOLUME .....   | 31 |
| B. METHODOLOGY AND RESULTS .....                          | 33 |
| 1. Total Volume versus Rate .....                         | 33 |
| 2. Model for Europe and Korea .....                       | 36 |
| 3. Smoothed Total Volume .....                            | 38 |
| V. CONCLUSIONS AND RECOMMENDATIONS .....                  | 41 |
| A. CONCLUSIONS AND RECOMMENDATIONS .....                  | 41 |
| B. RECOMMENDATIONS FOR FURTHER STUDY .....                | 42 |
| APPENDIX A. DATA TABLE FOR VOLUME .....                   | 45 |
| APPENDIX B. DATA TABLE FOR RATES ON SELECTED ROUTES ..... | 47 |
| LIST OF REFERENCES .....                                  | 49 |
| INITIAL DISTRIBUTION LIST .....                           | 51 |

## LIST OF FIGURES

|  |    |
|--|----|
| 1. MSC Cargo by Commodity.....   | 19 |
| 2. Total Cargo by Commodity.....   | 19 |
| 3. Rates for Special Cargo on Selected Routes .....                          | 20 |
| 4. Average Percentage Change in Rates .....                                  | 26 |
| 5. Total DoD Cargo Moved .....   | 31 |
| 6. Rate versus Total Volume .....  | 34 |
| 7. Special Cargo Moved on Selected Routes .....                              | 37 |
| 8. Actual and Smoothed Total Organic Volume .....                            | 38 |
| 9. Regression Results Using Smoothed Total Volume and No Offset .....        | 39 |
| 10. Regression Results Using Smoothed Total Volume and Two-Year Offset ..... | 39 |



## LIST OF TABLES

|   |    |
|---|----|
| 1. Sealift Dry Cargo Net Operating Result.....                    | 27 |
| 2. Regression Results for Total Volume .....                      | 36 |
| 3. Regression Results for Specific Routes .....                   | 38 |
| 4. Data Table for Total, Organic and JTMO Volume, 1984-1997 ..... | 45 |
| 5. Data Table for Rates on Selected Routes .....                  | 47 |



## **I. INTRODUCTION**

### **A. PURPOSE**

The purpose of this research is to examine the relationship between sealift volume and rates and to assess the working capital fund factors that affect the stability of transportation rates.

### **B. BACKGROUND**

Several trends are evident at the Military Sealift Command since 1985. Desert Storm and the subsequent Mobility Requirements Study focused attention on the need for strategic reserve forces and for prepositioned equipment ready for speedy deployment. Between 1994 and 2001, 19 ships will be added to these programs. At the same time, MSC's traditional role of supporting deployed units of all services with point-to-point transportation has declined. Overall cutbacks to the Department of Defense have decreased the amount of cargo handled by MSC from a high<sup>1</sup> in 1988 of 9.8 million measurement tons to 5.5 million measurement tons in 1998. MSC moves approximately 20 percent of these amounts on organic assets, with the remainder transported by commercially controlled liner vessels. In 1997, 89 percent of liner cargo was containerized. [Ref. 1, 1997]

The need for military-specific sealift has not and will not disappear entirely, because the services will continue to require overseas transportation of heavy equipment and items that cannot be containerized.

---

<sup>1</sup> Not including Desert Storm high of 22.1 million measurement tons.

In a Working Capital Fund environment, one expects rates to increase with a decrease in workload and vice versa. Costs are allocated over what is usually a fixed infrastructure, so that fewer customers bear a larger proportion of those costs. Because of the necessity to make up gains or losses from year to year, rates can fluctuate by a large amount from year to year. This research looks at the stability of sealift rates and the degree of flexibility that the working capital funds afford to MSC.

### **C. SCOPE AND METHODOLOGY**

This research tests the statistical validity of the assumption that rates increase when volume decreases. It will also address the flexibility and stability of working capital funds for estimating, setting and tracking rates at MSC. The focus will be on internal DoD issues between the working capital fund service provider and the unit customer rather than on DoD's relationship with the commercial shipping industry, though some discussion of the latter is appropriate.

The methodology used in this thesis research will consist of the following steps:

1. Conducting a literature search,
2. Contacting experts in sealift and sealift rates,
3. Reviewing pertinent transportation and Working Capital Fund regulations,
4. Reviewing and analyzing annual data on sealift rates and quantities shipped,
5. Providing conclusions with recommendations.

#### **D. ORGANIZATION OF THESIS**

Chapter II contains background information on defense transportation and introduces the various requirements in obtaining sealift transportation. Chapter III gives an overview of the history and purpose of working capital funds. Chapter III also explains how working capital fund requirements apply to sealift rates. Chapter IV analyzes rate and volume data. Chapter V contains conclusions and recommendations.





## **II. RELATIONSHIPS WITHIN THE TRANSPORTATION SYSTEM**

### **A. DEFINING SEALIFT**

Since 1992, the United States Transportation Command (USTC) has been the single manager for defense transportation in both peace and war. Two transportation component commands under USTC, the U.S. Navy's Military Sealift Command (MSC) and the U.S. Army's Military Traffic Management Command (MTMC), handle various aspects of the sealift mission while the third, the U.S. Air Force's Air Mobility Command, is concerned with airlift. The two options for moving cargo across oceans are surface transport and air; hence the terms sealift and airlift. During Desert Storm, sealift accounted for 85 percent of dry cargo shipped and airlift accounted for 15 percent<sup>2</sup>. [Ref. 2: p. 17]

Sealift is one of five business areas within MSC, each of which is headed by a program manager (PM), as follows:

- PM1—Naval Fleet Auxiliary Force provides ammunition, supply and tanker support to the numbered fleets.
- PM2—Special Mission ships conduct oceanographic and other specialized research.
- PM3—Prepositioning ships provide afloat storage in support of service needs.
- PM4—Ship Introduction oversee procurement of sealift assets, including the Large, Medium-Speed, Roll-on/roll-off (LMSR) ships.

---

<sup>2</sup> Including petroleum, oil and lubricants (POL), the numbers are 94% sealift and 6% airlift.

- PM5—Sealift provides ocean transportation.

The Sealift Program Office (PM5) is comprised of three divisions known as “projects.” These include the Dry Cargo Project, the Tanker Project for transport of petroleum, oil and lubricants (POL), and the Surge Project which maintains the Strategic Sealift Force to support exercises and contingencies. All three projects under Sealift account for approximately 19 percent of MSC’s expenses, and dry cargo—the subject of this research—accounts for approximately 7 percent of expenses. [Ref. 3]

## **B. ASSIGNMENT POLICY FOR COMMERCIAL VICE ORGANIC LIFT**

### **1. Customer Relationships**

The Defense Transportation System is defined as “that portion of the worldwide transportation infrastructure which supports DoD transportation needs in peace and war. The DTS consists of those military and commercial assets, services and systems organic to, contracted for, or controlled by the Department of Defense.” [Ref. 4: p. GL-9] The first part of the definition is self-explanatory. Section 2 below, “Ownership of Assets,” explains some of the nuances of ownership, contracting and control of military and commercial assets. DTS transactions are internal to the Department of Defense—between the U.S. Transportation Command or its component commands and the different branches. The external transactions are those between DoD representatives and the commercial industry. External relationships are discussed briefly in the section on rates.

A customer of the sealift side of the Defense Transportation System (DTS) might be a representative of the Joint Chiefs of Staff who is planning an exercise or a supply

center shipping an order. The Joint Traffic Management Office (JTMO) under MTMC enters customer requirements into an Integrated Booking System. JTMO books the cargo on a regularly scheduled, commercially owned and operated liner service<sup>3</sup>, if such service is available. If liner service is not available, the requirement is referred to MSC.

The Joint Traffic Management Office is a relatively new organization, having been established in 1996. Prior to 1996, MSC had a sixth Program Manager for Intermodal Operations which handled this type of activity. Operational responsibility for intermodal liner service transferred from MSC to MTMC in 1996. Financial responsibility transferred as of Fiscal Year 1999.

## **2. Ownership of Assets**

Seventy-nine percent of Department of Defense (DoD) cargo moves by commercial liner service [Ref. 1, 1997]. MSC has four alternatives for shipping the remaining 21 percent of peacetime cargo or for meeting a wartime contingency. First, MSC can "spot-charter" a commercial ship for a particular mission by negotiating a one-time contract with the commercial ship-owner. Second, MSC can negotiate a long-term charter under which MSC controls the schedule and route of a commercially owned vessel. Third, MSC has its own government-owned reserve assets, including the Large, Medium-Speed, Roll-on/roll-off (LMSR) ships and Fast Sealift Ships (FSS) in the

---

<sup>3</sup> According to Alan E. Branch's *Elements of Shipping*. [Ref. 5: p. 298], "The liner service implies the operation of a fleet of vessels which provides a fixed service at regular advertised intervals between named ports." "Liner," then, refers to the company operating such a service, the ship in such service or the service itself. "Liner cargo" refers to the cargo carried under such terms. Within DTS, liner service is distinctive in that it is regularly scheduled (as opposed to a one-time or spot charter) and in that the ship operator retains control of the scheduling and routing. DoD books space on the ship just as any other customer would.

Strategic Sealift Force. Fourth, the Ready Reserve Fleet (RRF), owned by the Department of Transportation, can be called into active service and placed under MSC control.

This research is concerned with the cargo carried by organic MSC assets, rather than by liner services. However, the transfer of the intermodal service from MSC to MTMC's Joint Traffic Management Office will have an impact on the rates for the services that MSC continues to provide, as will be discussed in Chapter 3, Section E2.

### III. WORKING CAPITAL FUNDS AND SEALIFT TRANSPORTATION RATES

This chapter serves a two-fold purpose—to provide the working capital fund context for the data to be analyzed in Chapter IV, and to focus the reader's attention on the very specific subset of MSC activity that will be analyzed.

The following excerpt from the Department of Defense Financial Management Regulation describes the basic concept of revolving or working capital funds.

Revolving funds were established to satisfy recurring Department of Defense requirements using a businesslike buyer-and-seller approach. The generators of requirements justify the need for funds to the Congress, but are not always the organizations that execute the requirement. In some instances, the "customers" or "buyers" contract with DoD "provider" or "seller" organizations that have expertise in the service or product required, and operate under business financial management principles. Unlike profit-oriented commercial businesses, the revolving funds goal is to break even over the long term. Revolving fund selling prices established in the budget are stabilized or fixed during execution to protect customers from unforeseen fluctuations that would impact on their ability to execute the programs approved by the Congress.

The basic tenet of the revolving fund structure is to create a customer-provider relationship between military operating units and support organizations. This relationship is designed to make managers of support organizations funded through DWCF [Defense Working Capital Funds] and decision-makers at all levels more concerned with the costs of goods and services. Requiring the operating forces to pay for support they receive provides increased assurance that services supplied and paid for are actually needed. [Ref. 6, vol. 2B: p. 9-1]

Operating units or other "customers"<sup>4</sup> or "buyers" generate requirements for sealift transportation, justify those needs to Congress and receive funding to contract with MSC to provide the service. The Military Sealift Command as the "provider" or "seller"

---

<sup>4</sup> Authorized customers are DoD activities, Non-DoD Federal Government Agencies and others when authorized. See Ref. 6, vol. 11B, p. 50-4.

has the expertise to “sell” the service in a businesslike manner. Most customers of working capital fund activities are appropriated fund activities, though working capital fund activities also require services from one another. In either case, the service provider bills the customer at a set rate and is reimbursed for services provided. Appropriated fund activities on the other hand, receive funding directly from Congress based on budget requests submitted annually.

The working capital “fund” itself is a pool of money called a corpus.

Business areas receive their initial working capital through an appropriation or a transfer of resources from existing appropriations of funds and use those capital resources to finance the initial cost of products or services. Financial resources to replenish the initial working capital and to permit continuing operations is generated by the acceptance of customer orders. [Ref. 6, vol. 11B: p. 50-1]

“Working capital” refers to the ready cash needed to carry on day to day operations while waiting for billing and reimbursement for services already rendered, and “fund” refers to the actual pool of money from which working capital is drawn. The working capital fund does not receive annual appropriations, but rather, after the corpus is established by the initial appropriation, money from customer orders is used to replenish the fund.

Section A below presents a brief history of working capital funds. Following this general introduction, Sections B and C place MSC and its dry cargo operations in the working capital fund context. Actual data on one of MSC’s many rates is presented in Section D and used in Section E to illustrate some of the finer details of tracking costs and setting rates. Concepts mentioned in the above excerpt which will be covered in more detail include break-even over the long run, stabilized rates, cost and cost goals, and management awareness of cost, as each applies to MSC sealift transportation.

## **A. PURPOSE AND HISTORY**

The excerpt below gives a brief history of working capital funds.

Modern day revolving fund authority is provided by the National Security Act of 1947 . . . Revolving fund activities evolved from two distinct categories. The first type, Stock Funds, dealt with procuring material in volume from commercial sources and holding an inventory. Subsequently, activities sold to the authorized customer who needed the item in order to achieve weapon systems readiness or provide required personnel support items. The second type, Industrial Funds, provided industrial and commercial goods and services such as depot maintenance, transportation, and research and development. Both types of revolving funds were financed primarily by reimbursements from customers' appropriated accounts.

The Department of Defense expanded the use of businesslike financial management practices through the establishment of the Defense Business Operations Fund (DBOF) on October 1, 1991. Building on revolving fund principles, cost and performance are linked together and the Fund's managers are expected to operate within cost goals established in operating and capital budgets.

DBOF combined existing commercial or business operations that were previously managed as individual revolving funds into a single revolving, or business management, fund. The Fund Treasury account has five subaccounts (one for each Military Department and Defense-wide). On December 11, 1996, the Under Secretary of Defense (Comptroller) reorganized DBOF and created four Working Capital Funds: Army, Navy, Air Force, and Defense-Wide. Further, on December 16, 1997, a separate Working Capital Fund was established for the Defense Commissary Agency effective in FY1999. This change retains the numerous benefits and improvements resulting from the implementation of DBOF while clearly establishing the Component's responsibility for managing the functional and financial aspects of their activities. [Ref. 6: p. 9-1]

One objective in establishing working capital funds within the DoD was to minimize the cost to the government of procuring goods and providing services. The DoD seeks to minimize duplicated effort and to consolidate government negotiation with



the commercial sector for various goods and services. The key objective, however, is to achieve "full cost visibility" and "total cost recovery."

Managers of activity groups within the Fund are required to set their prices based upon full cost recovery, including all general and administrative support provided by others. Prices are established through the budget process and except for the Depot Maintenance Activity Group<sup>5</sup>, remain fixed during the year of execution. This stabilized rate policy serves to protect customers from unforeseen inflationary increases and other cost uncertainties and better assures customers that they will not have to reduce programs to pay for potentially higher-than-anticipated prices. In turn, this policy allows activities to execute the budgeted program level and permits a more effective use of Fund resources.

Prices for the budget year will be set to recover costs over the long run. This means that prices will be set to achieve an Accumulated Operating Result (AOR) in the budget year of zero. During budget execution, activity groups will record either a positive or negative Net Operating Result<sup>6</sup>. Accordingly, prices in the budget year will be set to either make up actual or projected losses or to return actual or projected gains in the budget year(s)<sup>7</sup>.

In other words, know all the costs that apply to a particular job and allocate costs appropriately to customers via the customer rates [Ref. 4: p. iv and Ref. 6: p. 9-11]. Total costs include the following: 1) costs associated with ship operations (see Section E below), 2) all overhead, general and administrative support, such as MSC and U.S. Transportation Command overhead and the financial support provided by Defense Finance and Accounting Service, and 3) the costs associated with the centralized

---

<sup>5</sup> Depots adjust rates quarterly. Other activities adjust rates annually.

<sup>6</sup> Remember from the opening excerpt that the WCF goal is for revenues and expenses to break even. Positive or negative NOR is the difference between revenues and expenses. AOR is the accumulation of these differences.

<sup>7</sup> AOR losses may be recovered over a two-year period, though no more than 50% of the loss may be recovered in the second fiscal year. In some cases, extraordinary write-offs are not recovered by increased rates. See Ref. 6, vol. 2B: p. 9-14.

contracting undertaken by MSC in order to provide service. The primary tool used to achieve the objectives of cost visibility and recovery are stabilized billing rates. Net Operating Result, Accumulated Operating Result and Unit Costs Goals are other tools which are discussed and illustrated in more detail in Section E below.

All working capital fund activities set “stabilized rates reflecting full costing . . . The Fund includes a variety of activity groups that are categorized in two groups for rate setting purposes.” These groups are supply management activities and non-supply management activities. In the case of a supply or inventory management activity, the rate charged to the customer is the cost of the item plus a surcharge representing a percentage of overhead. In the case of non-supply management activities, where several customers may share a service, the task of dividing costs among customers is more difficult. “Depot Maintenance, Research and Development, Transportation, Distribution Depots, Base Support, and all other activity groups have unit cost rates established based on identified output measures or respective outputs. These output measures establish fully cost burdened rates per output, such as cost per direct labor hour, cost per product, cost per item received, cost per item shipped, etc.” [Ref. 6: p. 9-14] Transportation rates are based on cost per ship day or the volume of an item transported. In some cases, a cost-plus-overhead basis for billing is appropriate for a transportation service, as discussed in Sections B and C.

For further reading on working capital funds, see the DoD’s Financial Management Regulation [Ref. 6]. Volume 2b, Chapter 9 addresses policies relating to cash management of money in the fund under the cognizance of each activity group, the

formulation and submission of operating budgets to Congress, and policies on costs relating to capital investments, construction, mobilization costs and military personnel. Volume 11B delineates responsibilities within the Department of Defense for management of working capital funds, defines accounting standards and lists objectives of working capital funds.

The web page for the Office of the Under Secretary of Defense (Comptroller) has a wealth of information relating to both appropriated fund activities and working capital fund activities [Ref. 7]. The overview statements to the Audited Financial Statements describe some of the issues faced by each activity group.

The Government Accounting Office has looked into several aspects of working capital fund operations. Two reports on the subject of transportation include a 1996 report on the high rates charged within DoD compared to commercial rates and a follow-up report in 1998. [Refs. 8 and 9]

## **B. WORKING CAPITAL FUNDS AS THEY APPLY TO MSC**

Part of MSC's operations are funded by the Navy Working Capital Fund, and part by the Air Force Working Capital Fund, as explained below. Dry Cargo operations are funded entirely by the Air Force Working Capital Fund. The discussion of the Navy side of MSC business is provided only for context.

Two of MSC's five programs provide service-specific support to the Navy—the Naval Fleet Auxiliary Force (NFAF) and the Special Mission Ships<sup>8</sup>. These programs are funded by the Navy Working Capital Fund, along with the portion of the Prepositioning Program dedicated to the Navy and Marine Corps<sup>9</sup>.

Other transportation services, including MSC's Sealift Program, MTMC's intermodal liner service, and prepositioning services performed for the Army, Air Force, and DoD agencies are funded through the Air Force Working Capital Fund. The portion of the Air Force Working Capital Fund for which the U.S. Transportation Command (USTC) has management authority is referred to as the Transportation Working Capital Fund, though it is not in fact a separate fund. The affiliation between the U.S. Transportation Command and the Air Force Working Capital Fund is a matter of convenience, given that USTC is collocated at Scott Air Force Base, Illinois with Headquarters, Air Mobility Command.

### **C.     DEFINING “COMMON-USER”—THE PROBLEM OF DISTRIBUTING COSTS**

#### **1.     Sponsorship**

For many of the services provided by MSC, distributing costs is not an issue because the service is provided to a single sponsor. For example, the Army pays the

---

<sup>8</sup> Special Mission Ships are hired out on a per diem basis to Navy sponsors as well as to sponsors from other DoD agencies. Four of MSC's five programs are addressed in this section on working capital fund operations. The fifth program, Ship Introduction, is funded by direct appropriation.

<sup>9</sup> The Army, Air Force, and Defense Logistics Agency also sponsor prepositioning ships which are not Navy-funded.

entire cost for each of the prepositioning ships dedicated to Army use. The Navy numbered fleets pay for the Naval Fleet Auxiliary Force supply ships which support deployed units. Within the Sealift Program, when the Joint Chiefs of Staff (JCS) charters an entire ship to move cargo for a JCS-sponsored exercise, JCS pays the bill. In these cases, billing is based on a daily, or per diem rate.

An alternative to the per diem rate is the point-to-point rate. Point-to-point rates are appropriate when cargo for several customers is carried on one ship. The ship is thus employed in common-user service. Similarly, when the Department of Defense enters into contracts with commercial shipping companies for common-user liner services, the ship will be shared with other non-DoD cargo. The measurement-ton, corresponding to 40 cubic feet, is the volumetric unit used to assign costs to multiple customers on MSC-controlled ships.

## **2. The Process of Assigning Lift**

As mentioned previously, a liner service with an established route and established rate receives the first offer on all cargo booked through MTMC's Integrated Booking System. Even if the liner does not serve the origin and destination or does not have scheduled service that meets the time requirements, the liner may still chose to accept the "off-route" requirement.

Once the liner options have been exhausted, MSC considers its own assets. The MSC-controlled ships in common-user service are commercially owned ships under long-term charter to the government. The number of ships in this type of service has declined precipitously since the end of the Cold War. According to MSC sealift analyst Al Grace,

"I used to have 16 ships for Europe. Now I have one-half." [Ref. 10] The remaining four dry cargo ships in worldwide service can be scheduled as needed; though obviously the capacity is limited<sup>10</sup>.

MSC has come to rely on the three options discussed under "Ownership of Assets" in Chapter 2, Section 2 to augment an MSC-controlled fleet of long-term charters. These include spot-chartering a commercial vessel, activating an MSC asset or activating a Ready Reserve Fleet ship from Reduced Operating Status. These one-time requirements are more likely to involve the cargo of a single sponsor, though some common-user cargo may be included. [Ref. 3: p. 2-13]

#### **D. HISTORICAL BILLING RATES**

The rates analyzed in Chapter IV are point-to-point rates, as opposed to per diem rates, both of which can apply to dry cargo. From the approximately 5,000 point-to-point rates representing some 600 routes and eight commodity classifications, only one commodity classification, special cargo, and four routes will be analyzed in detail. This section describes the rate classifications, gives the rationale for selecting special cargo as a representative commodity for analysis in Chapter IV, and presents the data on the stabilized billing rates, hereafter referred to as billing rates, selected for analysis.

---

<sup>10</sup> Of the four, all but the Maersk Constellation are specialized vessels. The Strong Texan is a heavy lift ship, Green Wave is ice-hardened, and Margaret Chouest is dedicated to Diego Garcia resupply. In 1998, two roll-on/roll-off ships American Condor and American Falcon, representing half the capacity of the MSC-controlled fleet, were removed from MSC service and redelivered to their owners. The trade-off for fleet-sizing decisions is between the flexibility of having the fleet versus the cost of maintaining it. See also the discussion of gains and losses on page 24.

## **1. Route Classifications**

The Military Sealift Command publishes billing rates for dry cargo in the form of a Billing Rate Instruction [Ref. 11]. The basic instruction was published in 1992, and the updated rates are published each year as change transmittals to the basic instruction. Point-to-point rates are based on 58 MSC traffic areas, which according to the instruction were “established for the purpose of combining certain ports or regions for billing and statistical purposes.” These include four continental U.S. coastal categories—East, West, California, and Northwest Coasts—two inland categories for the Great Lakes and Mississippi River, and 52 areas world-wide such as Europe, Korea, and the Hawaiian Islands. Each row in the rate table represents a different origin-destination pair from among these areas.

## **2. Commodity Classifications**

The applicable rate depends on the commodity being shipped as well as the origin and destination. Each column of the rate table represents one of the following commodities: refrigerated, bulk, personally owned vehicles (POV), ammunition and explosives, general, special (military equipment and vehicles), and aircraft. Special cargo is the bulk of the cargo shipped by MSC, as illustrated in Figure 1. Note, however, that more than half of all DoD cargo is classified as general cargo. This commodity category tends to be booked through JTMO and carried by liners rather than by MSC, as illustrated in Figure 2. The discussion of historical rates below and the analysis in Chapter IV are based on the rates for special cargo because this category is most representative of MSC’s

core business. Sixty-one percent of MSC's cargo is classified as special, and 69 percent of all special cargo is carried by MSC.

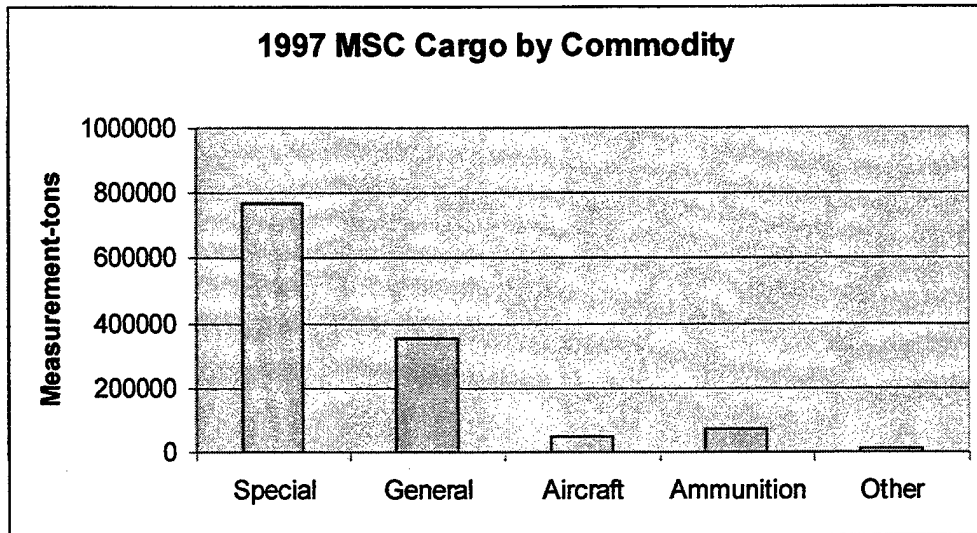


Figure 1. MSC Cargo by Commodity [Ref. 1, 1997].

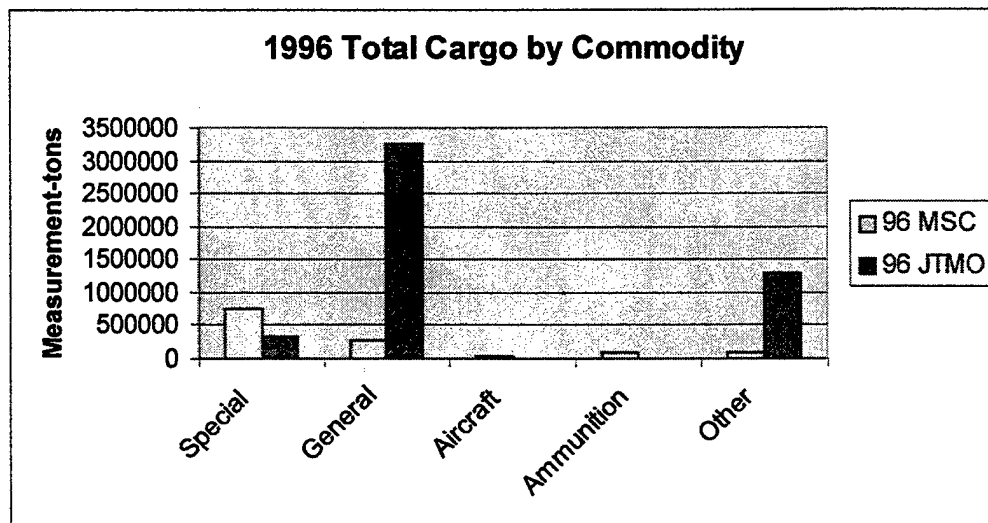


Figure 2. Total Cargo by Commodity<sup>11</sup> [Ref. 1, 1997].

<sup>11</sup> Beginning in 1997, MSC annual reports show total JTMO cargo with no commodity classifications. 1996 data included the commodity classifications.



### 3. Historical Rates for Special Cargo

Four rates for special cargo to various geographical locations appear in Figure 3 and are discussed below. The routes were selected to represent a wide range of rates and examples of international destinations receiving significant amounts of traffic. Section E describes how these rates were initially set and how they are updated annually.

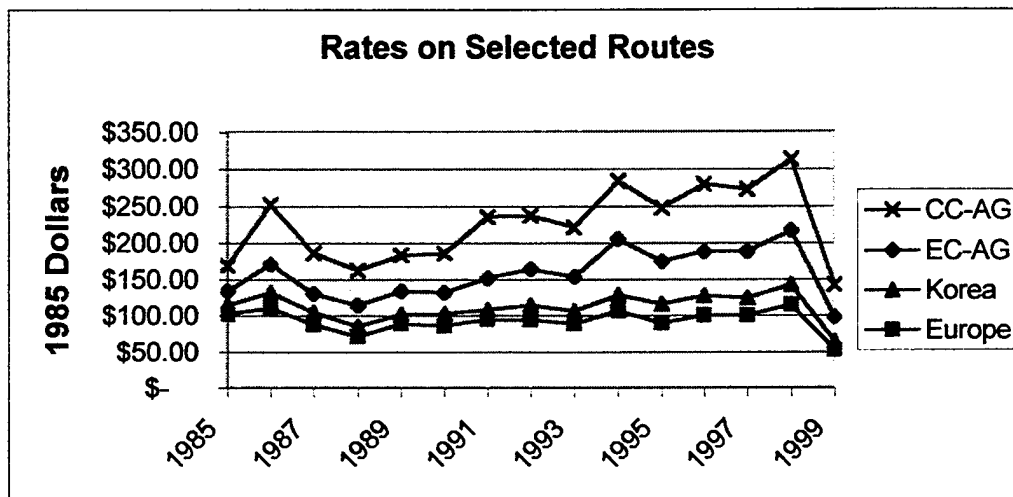


Figure 3. Rates for Special Cargo on Selected Routes [Ref. 11, Ref. 12].

### 4. Applying a Rate with Mileage Figured In

The point-to-point rates for each commodity were initially formulated on a mileage basis. The route designated "CC-AG" from the California Coast<sup>12</sup> to the Arabian Gulf has the highest mileage and therefore the highest rate. An example of a route in this category would be from San Diego to Kuwait. The same rate applies in

<sup>12</sup> For the purposes of rate categories, the U. S. West Coast is divided between the California Coast and the Northwest Coast, hence the more specific designation on the West Coast than the East.

either direction between the two ports<sup>13</sup>. "EC-AG" designates routes from the U.S. East Coast to the Arabian Gulf. The "Korea" category designates routes between the California Coast and Korea. "Europe" designates routes between the East Coast and Europe. Representative mileage for each route is listed below:

- California Coast to the Arabian Gulf (San Diego to Kuwait): 13,392 miles
- East Coast to the Arabian Gulf (Norfolk to Kuwait): 9,798 miles
- California Coast to Korea (San Diego to Pusan): 6,339 miles
- East Coast to Europe (Norfolk to Rotterdam, the Netherlands): 4,165 miles<sup>14</sup>

Rates are not exactly proportional to mileage, but these examples show mileage is figured in and higher rates are associated with longer routes.

The following example illustrates how rates are applied. Because mileage is already factored into the rate, applying the rate requires only the measurement-tonnage of the item to be shipped. Consider an M1A1 tank weighing approximately 124,000 pounds, or 61 short tons. The outer dimensions of the vehicle when reduced to minimum shipping dimensions are approximately 30 feet long by 12 feet wide by 9.5 feet high, or 3,420 cubic feet [Ref. 13]. One measurement-ton equals 40 cubic feet, so the 3,420-cubic-foot M1A1 measures 86 measurement-tons<sup>15</sup>. The shipping industry's use of

---

<sup>13</sup> Though the same rate applies in either direction, four-fifths of the dry cargo (JTMO and organic) passing through Continental U.S. coastal ports is outbound. In 1997, 4.1 million measurement-tons were outbound, and 952 thousand were inbound [Ref. 1, 1997].

<sup>14</sup> Mileages are listed in *Logistics Handbook for Strategic Mobility Planning* [Ref. 14]. Appendix D of that publication lists mileage in terms of nautical miles, converted here by a factor of 1 mile = 1.15 nautical mile.

<sup>15</sup> The *Logistics Handbook* lists conversion factors from short tons to measurement-tons for various commodities in Appendix G. For the M1A1, the conversion factor is 1.38 (approximately the 86 m/t

measurement-tons is based on the concept that given two items for shipment—one heavier but taking up less space and the other lighter but taking up more space—the rate is higher for the item taking up more space. For example, rates for general cargo, packed efficiently into containers and easily stackable, are lower than rates for vehicles, which are not stackable, leaving empty space above the vehicle, as well as in the passenger compartments<sup>16</sup>. The charge to ship the 86 measurement-ton M1A1 to Europe in 1999 at a rate of \$74.65 per M/T would have been \$6,420. The charge to ship to Korea in 1998 at a rate of \$198.35 per M/T would have been \$17,058.

## **E. UNIT COST AND NET OPERATING RESULT**

### **1. Billing Methods and Unit Costs**

Working capital fund activities formulate rates by estimating cost and workload, as described in the Financial Management Regulation.

1. Each Service or DoD Component managing an activity group should carefully review all projected costs for all operations projected for the fiscal year, and propose the most cost-efficient operation possible.

2. Customer requirements must be projected to include all anticipated work load programmed for accomplishment during the budget year based on identified outputs such as direct labor hours by product, tons shipped, line items received, and all other approved output measures for each activity group.

3. Adjustments required to conform to OSD [Office of the Secretary of Defense] and OMB [Office of Management and Budget] guidance on the impact of inflation, projected pay changes, and other

---

divided by 61 s/t used above). The standard conversion factor of 1.0 would apply to an item measuring 40 cubic feet and weighing one short ton. Space utilization is the primary distinguishing factor among commodity rates, though other considerations include the amount of handling required to position and secure the item.

<sup>16</sup> Compare 1999 rates to Europe of \$52.20 for general cargo and \$74.65 for special cargo.

programmatic and policy changes will also be included by Components in developing proposed rates.

4. DoD Components will proposed costs, program levels, and rate changes by activity group in their budget estimate submissions . . .

5. Final approved costs, program levels, and rate changes will be established by Program Budget Decision documents, after adjustments required to balance changes in customer account program levels with anticipate Fund costs, inter-Fund sales and transactions, and adjustments for NOR in order to bring Accumulated Operating Result to zero for the Budget Year for each activity group.

This section addresses the costs and adjustments that apply to ocean transportation.

For the dry cargo section of MSC's Sealift business area<sup>17</sup>, MSC has several options for providing service to other DoD customers. These options—time charters, spot charters, or Ready Reserve Fleet activations—share some cost characteristics and have others that are unique. All ship operations incur costs for the fuel, crew and running of the ship. These costs will vary depending on the length of the voyage. MSC also incurs expenses for contracting, administration and overhead<sup>18</sup>. A charter contract between a ship owner and the government will include capital costs for the vessel, such as the initial construction of the ship. The capital costs for the Ready Reserve Fleet, on the other hand, are borne by the National Defense Sealift Fund<sup>19</sup>. Port costs vary from

---

<sup>17</sup> Dry cargo is distinct from petroleum tanker services, which are also provided under the Sealift Program. MSC business areas are synonymous with the Program Offices: Sealift, Prepo, NFAF, etc. See Chapter II.

<sup>18</sup> Overhead applied includes MSC overhead and a percentage of USTC overhead. USTC overhead is not charged to the portion of MSC business which is funded by the Navy Working Capital Fund.

<sup>19</sup> The Ready Reserve Fleet is used primarily for exercises and contingencies. The Navy-sponsored National Defense Sealift Fund pays for the maintenance and upkeep of the RRF ships when they are not in use [Ref. 3: p. 2-2].

port to port, depending on whether port authorities require entry fees or tug boats and harbor pilots. All of these costs are passed on to customers in one of three manners.

These three methods of billing are 1) reimbursable, or cost plus overhead, 2) per diem rates and 3) point-to-point rates. Cost plus overhead is appropriate for some spot charters and Ready Reserve Fleet ships activations. For such short-term requirements with one sponsor, there is no need to divide or allocate costs. A single sponsor pays a single bill. Per diem rates are appropriate for longer-term requirements with single sponsors. The question is not one of how to allocate costs among customers, but one of how to collect payment from a single customer in a timely manner. All costs are divided by the expected number of days in service, so the rate is literally the cost per day. Point-to-point rates are appropriate when costs for overlapping voyages must be allocated among multiple customers. That allocation is based on the amount of space taken up on the ship in terms of measurement-tons. The point-to-point rate is also referred to as the measurement-ton rate. The initial formulation of the rates would have required an estimate of the total costs of voyages on point-to-point routes divided by total measurement-tons-miles—the mileage that each measurement-ton had been carried. This basic rate would have been multiplied by a mileage factor for various routes and adjusted by commodity as discussed in Section D.

All working capital fund activities such as MSC formulate “unit costs” and “unit cost goals” in order to track the cost of providing service and to provide a fair method of billing. In general, the formula for unit cost is overall cost divided by workload. For services billed on a per diem basis, the unit cost is the per diem rate for the type of ship,

or overall cost divided by ship days. Only since FY 1999 has MSC developed separate unit costs for dry cargo operations billed on a per diem basis, as opposed to on a reimbursable and point-to-point basis<sup>20</sup>. Unit cost for a given year is the actual cost divided by the actual workload. Unit cost goal equals estimated costs divided by estimated workload: it is proposed by the working capital fund activity and approved during the budget process. The FY 1998 unit cost goal of interest at present<sup>21</sup> was equal to estimated expenses of \$112 million divided by 4,521 millions of measurement-ton-miles. This resulting \$24,818 per million measurement-ton miles is the goal by which the actual unit costs will be judged at the end of the fiscal year. To exceed the approved unit cost goal requires justification. Unit cost is a performance measure used to track the cost of providing service from year to year. The figure \$24,818 did not equate to any particular rate, but rather is divided out across the rates for routes and commodities in the billing rate table<sup>22</sup>. Millions of measurement-ton-miles is MSC's approved measure of output for activity billed under point-to-point rates. Using this basis for computation gave an amount on the same order as per diem unit cost goal that applies to dry cargo, which for 1999 is \$35,246. [Ref. 3: p. 2-8]

---

<sup>20</sup> Unit costs for prepositioning, tankers and strategic surge were formulated on a per diem basis, but the unit cost for dry cargo was formulated on a measurement-ton-mile basis no matter how it was actually billed.

<sup>21</sup> MSC has nine unit cost goals for various business areas. Two are formulated on a M/T-mile basis—one for containerized cargo and a slightly higher one for breakbulk (non-containerized) cargo. The figures presented apply to non-containerized cargo.

<sup>22</sup> See Section D.

## 2. Adjusting Rates for Net Operating Result

Figure 3 above shows that the rates on four routes move in the same direction, though the degree varies from route to route. Figure 4 below shows the percentage change, averaged across all routes and commodities, for the years 1993 through 1999. Rates for each route are adjusted individually based on factors that affect the particular route. Figure 4 shows the average. Changes in cost, such as changes in the price negotiated with the commercial ship owners or changes in fuel costs, are the main element of rate fluctuations. The actual rate billed will also include an adjustment for money gained or lost during the prior years.

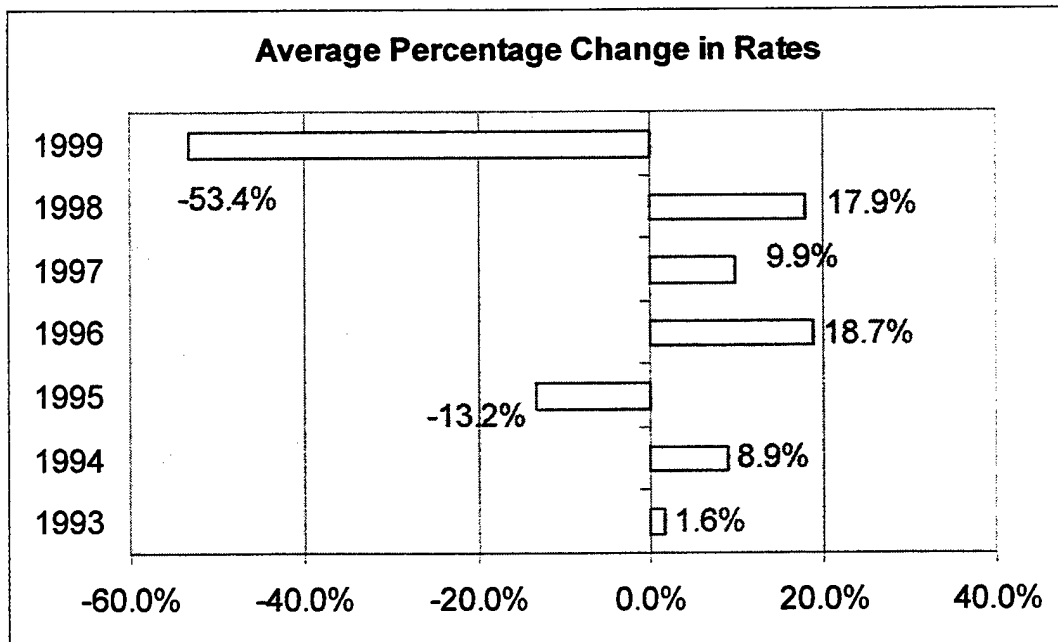


Figure 4. Average Percentage Change in Rates [Ref. 11].

Gains and losses are arrived at as follows. MSC establishes rates at the outset of the fiscal year based on estimates of revenues and expenses tied to workload will be during the coming year. For example, during 1998, the budget for the fiscal year 2000

was prepared, as shown in Table 1. The revenue estimate for 2000 is based on the rate and the workload estimated for 2000. Costs are estimated based on the factors discussed above under unit costs. Ideally, workload estimates would be exact and revenue would match costs. The difference, positive or negative, between revenue and costs for the year of execution is reported as the activity's "net operating result." Gains are paid back in the form of rate cuts and losses are recouped in the form of rate increases. AOR in Table 1 refers to "accumulated operating result," which is the sum of all previous net operating results. The goal for planning purposes is to reach an AOR of zero after two years. This two-year recovery factor is theoretical and AOR is updated every year.

| <b>TOTAL (\$000,000)</b> | <b>FY 1998</b> | <b>FY 1999</b> | <b>FY 2000</b> | <b>FY 2001</b> |
|--------------------------|----------------|----------------|----------------|----------------|
| <b>Revenue</b>           | 639.0          | 111.6          | 126.0          | 125.3          |
| <b>Expense</b>           | 582.9          | 131.8          | 125.1          | 125.3          |
| <b>NOR-Profit/(loss)</b> | 56.1           | (20.2)         | .9             | 0.0            |
| <b>AOR</b>               | 19.3           | (0.9)          | 0.0            |                |

Table 1. Sealift Dry Cargo Net Operating Result [Ref. 3: p. 2-13].

The \$451 million drop in expenses from FY 1998 to FY 1999 represents the transfer of financial responsibility for the liner business from MSC to the Joint Traffic Management Office. Most of the \$528 million drop in revenues is attributable to the transfer, and some is a planned loss to make up for excessive gains. As mentioned previously, liners carry 81 percent of sealift dry cargo and the establishment of the Joint Traffic Management Office occurred in 1996.

Gains or losses may be planned or unplanned. An example of the latter occurred in FY 1998, when MSC and JTMO incurred a \$56.1 million gain. Gains must be paid



back in the form of rate cuts, resulting in a planned loss in FY 1999 of \$20 million to make up for gains in FY 1998. The rate cut is evident in Figure 4 as the 53 percent drop in rates. The net operating result (NOR) for the MSC's dry cargo business area is applied only to the point-to-point rate table. Per diem rates are not adjusted, though consideration is being given to doing so. In the past, expenses and revenues for per diem activities were known with a higher degree of certainty. However, as MSC applies per diem rates to a wider range of activities that were formerly billed on a cost-plus-overhead or point-to-point basis, gains and losses will require that NOR adjustments be applied to per diem rates as well. The effect on point-to-point rates is that fluctuations might be greater than they would be otherwise.

The theory behind AOR and NOR is the Department of Defense stabilized rate policy, under which most working capital fund rates are held steady throughout the year. The second excerpt from the Financial Management Regulation in Section A discusses the rationale for this policy with respect to appropriated fund activities and the effect on working capital fund activities. Prior to implementation of this policy in the 1970's, MSC could, for example, change its rates repeatedly during the year when oil prices changed. From the perspective of an appropriated fund customer, an unexpected increase in rates for the types of support provided by working capital fund activities would take money away from programs that had been approved for the customer activity. Under stabilized rates, MSC calculates NOR for the year and recovers losses or returns gains in subsequent years.

The 53 percent reduction in rates for 1999 is based on two factors. First, a gain may have been planned to make up for losses in previous years, but an excessive gain (\$56 million) in 1998 led to substantial rate reductions in 1999. MSC's share of planned losses is estimated at \$20 million for 1999. When the American Falcon and American Condor were removed from the controlled fleet, MSC lost revenues but no longer bore costs. This may also have contributed to the unexpected gain. Second, JTMO set the rates that applied to both liner service and MSC's organic service for 1999. The revenue generated at those rates will cover the costs that JTMO incurs, but for MSC, the revenue generated at the same rates will not cover costs. For FY 2000, MSC will set its rates independently. Analysts estimate that those rates will be double the 1999 rates (back up to 1998 levels, in other words). 1999 rates are not considered in the following analysis.

[Ref. 15]

#### **F. FIXED AND VARIABLE COSTS**

In the working capital fund context, total cost recovery requires that all variable costs associated with a particular job are recouped, as well as a fair share of fixed costs, such as infrastructure and overhead. As workload declines, variable costs are incurred only for the work that continues to be done—for the ships that continue to be in operation, for example—but the fixed costs usually continue indefinitely. Fixed costs can be reduced eventually, but not immediately. The result is that a smaller group of customers each pays a greater share of fixed costs. The specific share is determined during the unit cost formulation in which estimated costs, both fixed and variable, are divided by estimated workload.

While it seems that a capital-intensive organization such as MSC would have high fixed costs, it does in fact have greater flexibility to remove ships from its infrastructure than another organization such as a repair depot has to close part of a facility or reduce workforce. MSC does not have any particular advantage in reducing overhead.

Even with that flexibility, volume still plays a part in increasing rates, as the following analysis will show.

#### IV. STATISTICAL ANALYSIS OF RATES AND VOLUME

This chapter presents data on volume and analyzes the relationship between volume and rates presented in Chapter III.

##### A. VOLUME

Figure 5 below shows the total DoD cargo moved by MSC from 1984 to 1997. "JTMO" refers to DoD cargo moved on commercial liner services and managed by the Military Traffic Management Command's Joint Traffic Management Office. Cargo moved aboard MSC-controlled vessels is referred to as "organic."

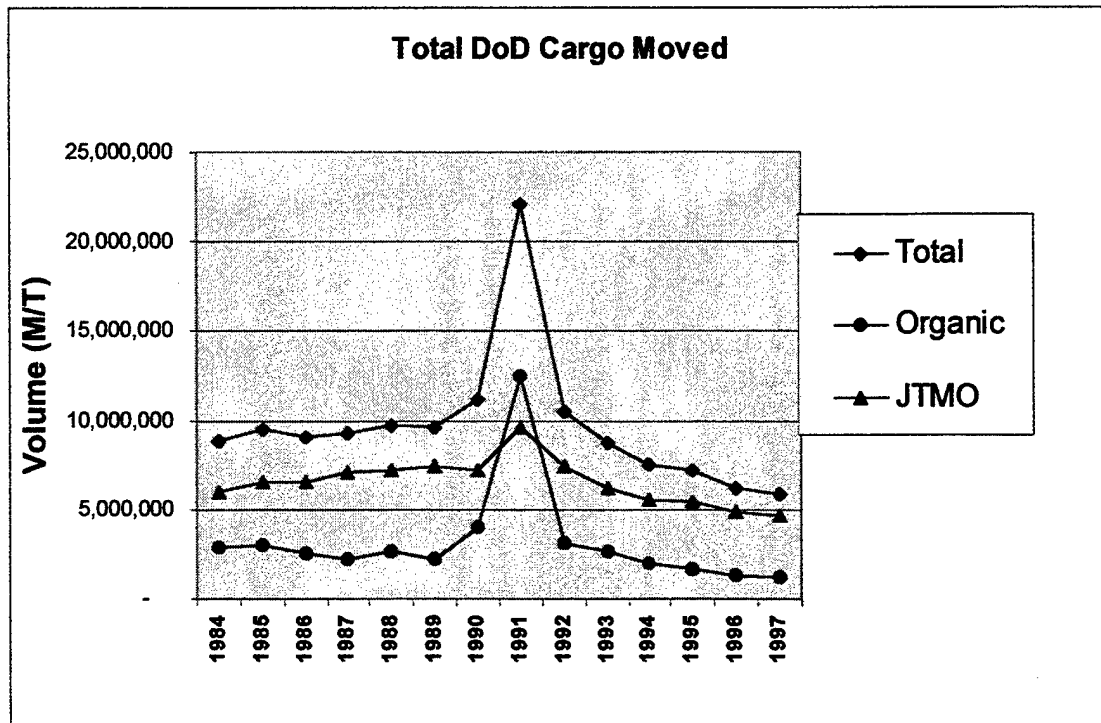


Figure 5. Total DoD Cargo Moved [Ref. 1, 1985-1997].

The peak of 22 million measurement-tons represents the cargo moved in support of Desert Storm in 1991. Ships activated from the Ready Reserve Fleet and placed under MSC control account for the greater spike in organic cargo than in liner cargo. In 1991, organic cargo accounted for 56% of total cargo, as opposed to a more typical 20 to 30 percent.

Two trends mentioned earlier are evident from this graph. First, the decline in overall cargo since 1992 is in keeping with cutbacks throughout the military. Second, JTMO accounts for a growing percentage of the total DoD cargo moved—71 percent in FY92 and 81 percent in FY98. Sealift analysts estimate that organic cargo has stabilized around 1.2 million measurement-tons [Ref. 3: p. 2-7].

In terms of reliability, data is equally vulnerable to over- and under-statement. MSC published the data used for the Figure 5 and Appendix A in a series of annual reports. The information in the annual reports was based on the cargo manifest documents for each shipment, which list type of cargo and volume, along with other information relevant to the shipment. The types of error affecting the collection method are illustrated as follows. On one hand, when manifests are not submitted to MSC properly, volume may be understated. On the other hand, cargo might be under- or overstated when one vessel is dedicated to a particular job. The per diem billing rate does not depend on the exact amount of cargo shipped, so an unverified estimate from the shipper or the carrier<sup>24</sup> may appear on the manifest. Despite the inaccuracies, MSC analysts

---

<sup>24</sup> The shipper is the owner of the cargo. The carrier provides the transportation and operates the vessel.

consider data on total volume to be reasonably reliable and representative of trends in MSC's actual workload.

## **B. METHODOLOGY AND RESULTS**

Figure 3 shows that rates have tended upward since 1985. Figure 5 shows that organic volume tended downward from 1985 to 1989 and again from 1992 to 1997, interrupted by Desert Storm. Regression analysis shows that there is a statistically significant relationship between the two over the long term, but that volume is not a significant predictor of yearly fluctuations in rates. Two models demonstrate this point. The first, Total Volume versus Rate, looks at actual total organic volume. The second, Model for Europe and Korea, looks at particular routes.

A third model, Smoothed Total Volume, presents a hypothetical case in which the peak produced by Desert Storm, affecting the years 1990 through 1993, is represented by only a very slight increase in volume. This model demonstrates that without Desert Storm, volume would have been a significant predictor of yearly fluctuations.

### **1. Total Volume versus Rate**

The first model compares total organic volume to a representative rate. Any of the rates discussed above would be appropriate for this analysis, because of the similar direction and degree of adjustments from year to year. Analysis using the rate for Europe is presented below. Figure 6 shows the dependent variable, the rate for Europe, on the Y axis and the independent variable, volume, on the X axis. Zero appears to the right on the X axis in order to show the upward trend in rates over time. For example, in 1990, four

million measurement-tons of cargo were shipped, and the rate to Europe at the time was \$97 per measurement-ton. From Figure 3, remember that rates on other routes varied from under \$100 to over \$200. The data point representing the 12.5 million measurement-tons of organic cargo shipped in 1991 for Desert Storm does not appear in Figure 6 and was not used for the analysis. Regression will determine the significance of the linear pattern in the data, representing a predictable relationship between the variables. The data in Figure 6 does appear to show a linear pattern.

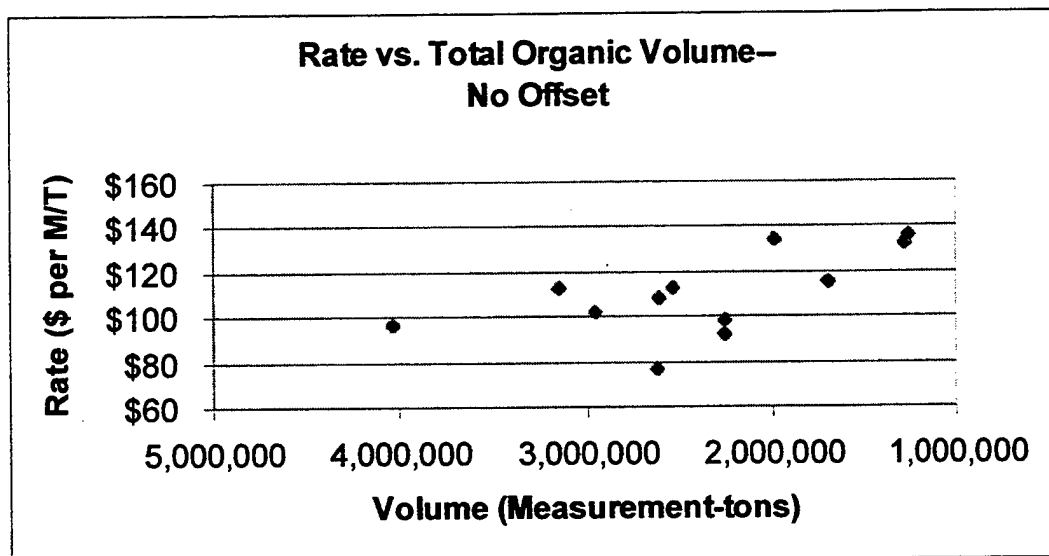


Figure 6. Rate versus Total Volume.

An additional variable is added to the regression model: a time factor measured simply by the values 1 through 13 for each annual observation. The time factor has the effect of regressing the downward trend in volume against the upward trend in rates, as opposed to individual observations. Table 2 shows the results with and without the time factor. In addition, three iterations are run on each model to test for the significance of the two-year factor for returning gains and recouping losses and the use of 1998 data for

formulating 2000 estimates. One expects events in 1998 to have a lagged effect lasting until 2000. These iterations are accomplished by running regression on the data with no offset, a one-year offset, and a two-year offset. The 12.5 million measurement-tons in 1996 has been averaged between 1990 and 1992 for the analysis involving offsets.

Table 2 contains a summary of key statistical indicators. A brief review of the terms used in Table 2 follows.  $R^2$  can be thought of as the percentage of rate variability explained by the model.  $R^2$  is usually inconclusive. F indicates whether or not the  $R^2$  is statistically significant. An F-test greater than four indicates a significant relationship. An F-test less than four indicates that the relationship between the variables is insignificant. An F-test equal to four is inconclusive and requires further analysis. Just as the F-test is an indicator for the whole model, the t-statistic applies to individual variables. A t-statistic of two is inconclusive. A t of greater than two indicates a relationship and less than two, no relationship. Where t is inconclusive, a p-statistic approaching zero on a scale of zero to one indicates significance.

The following observations can be made by from the data in Table 2 for the cases discussed above. Including a time factor increases  $R^2$  from 0.36 to 0.57. Including the two-year offset increases  $R^2$  again to 0.69. The cases including time factors show that trends in the data, represented by the time factor, have a t-statistic greater than two, while volume alone has a t-statistics of substantially less than two. Hence the conclusion that volume does not explain yearly fluctuations in rate. The 80 percent  $R^2$  using the Arabian Gulf rate does not indicate a better model. Rather, the inflationary factors relating to the Arabian Gulf rate lead to an overstatement of the statistical relationship. The case is



included in the analysis to demonstrate that the lower rate for Europe provides more meaningful results.

| Case   | R <sup>2</sup> /F<br>(>4) | Time factor |             | Volume      |             |
|--|---------------------------|-------------|-------------|-------------|-------------|
|  |                           | t-stat (>2) | p-stat (0%) | t-stat (>2) | p-stat (0%) |
| No time factor   |                           |             |             |             |             |
| No offset  | 0.36/5.6                  | --          | --          | 2.3         | 0.04        |
| One-year offset  | 0.21/3.2                  | --          | --          | 1.8         | 0.10        |
| Two-year offset  | 0.20/2.7                  | --          | --          | 1.6         | 0.13        |
| Including a time factor  |                           |             |             |             |             |
| No offset  | 0.57/6.0                  | 2.11        | 0.06        | 0.9         | 0.35        |
| One-year offset  | 0.55/6.2                  | 3.3         | 0.01        | 0.29        | 0.79        |
| Two-year offset  | 0.69/11.1                 | 3.99        | 0.00        | 0.6         | 0.56        |
| Using higher rate for Cal. Coast-Arabian Gulf vice East Coast-Europe |                           |             |             |             |             |
| No offset  | 0.81                      | 4.1         | 0.00        | 1.3         | 0.22        |
| One-year offset  | 0.80                      | 5.4         | 0.00        | 0.07        | .94         |
| Two-year offset  | 0.80                      | 5.6         | 0.00        | 0.36        | 0.72        |

Table 2. Regression Results for Total Volume.

## 2. Model for Europe and Korea

The second model compares special cargo on routes to Europe and Korea to the rates for the respective routes. Special cargo is the most appropriate category for analysis for two reasons. First, MSC tracks volume on specific routes by type of cargo (special, general, ammunition, etc.) rather than by carrier (organic or JTMO). Second, Figures 1 and 2 show that special cargo is MSC's most important commodity category. Figure 7 shows volume on the routes between the East Coast and Europe and the California Coast and Korea for the years 1990 through 1998.

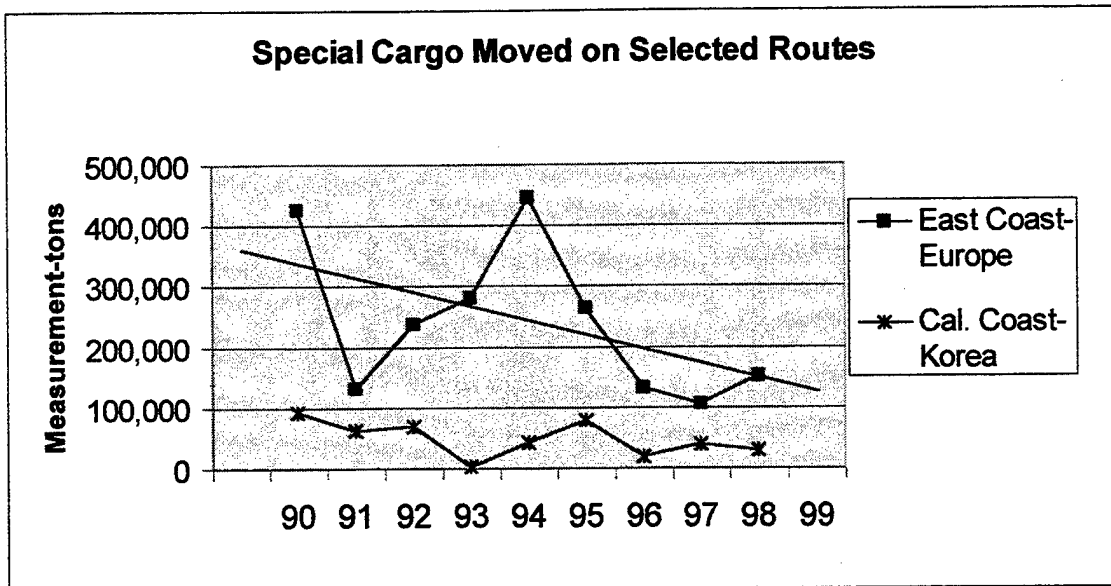


Figure 7. Special Cargo Moved on Selected Routes [Ref. 16].

The trends in volume are downward for both routes. The peaks and valleys represent support of exercises and normal peacetime operations. The regression results, presented in Table 3, are similar to the results using total volume. F-tests range from 4.8 to 25.0, indicating that the  $R^2$  are conclusive. T-statistics for the time factor are high, while t-statistics for volume are low.

The stronger results for the specific routes compared to total volume is a result of the shorter time frame. From 1990 to 1998, rates on all routes had a consistent upward trend. The data for total volume includes a period when rates decreased from 1986 to 1988. The shorter time frame also affects the significance of the offset. Without the early dip in rates, the offset does not make a significant difference. In the case of total volume and the rate for Europe, the offset did improve the  $R^2$  significantly. Both models lead to the same conclusion: the relationship between trends in rates and volume is significant, but volume is not a significant predictor of yearly fluctuations in rate.

| Case                                    | R <sup>2</sup> | Time factor |             | Volume      |             |
|---|----------------|-------------|-------------|-------------|-------------|
|   |                | t-stat (>2) | p-stat (0%) | t-stat (>2) | p-stat (0%) |
| East Coast to Europe—Special Cargo      |                |             |             |             |             |
| No offset                               | 0.79           | 4.2         | 0.01        | 0.26        | 0.80        |
| One-year offset                         | 0.75           | 3.0         | 0.04        | 0.86        | 0.43        |
| Two-year offset                         | 0.71           | 2.9         | 0.04        | 0.23        | 0.83        |
| California Coast to Korea—Special Cargo |                |             |             |             |             |
| No offset                               | 0.90           | 6.3         | 0.00        | 0.28        | 0.78        |
| One-year offset                         | 0.87           | 4.9         | 0.00        | 0.28        | 0.79        |
| Two-year offset                         | 0.84           | 4.0         | 0.02        | 0.13        | 0.90        |

Table 3. Regression Results for Specific Routes.

### 3. Smoothed Total Volume

The third model presents a hypothetical situation in which the effects of Desert Storm on volume have been smoothed out, as illustrated in Figure 8.

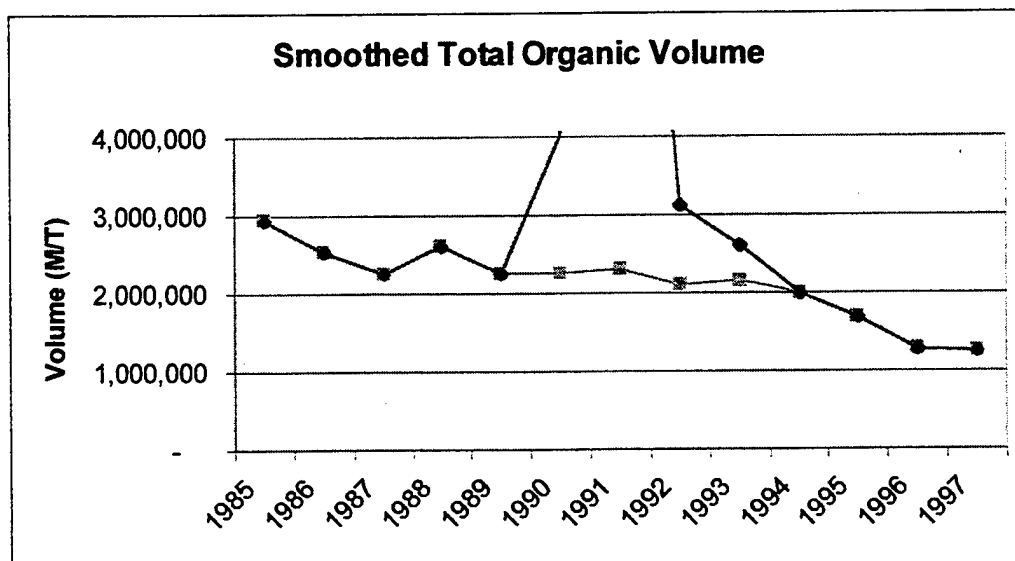


Figure 8. Actual and Smoothed Total Organic Volume.

The R<sup>2</sup> results are very similar to the results of analysis using actual volume and a time factor. Figures 9 and 10 show graphic representations of the data. The curved line

shows the time sequence of the data, with earlier data to the left at lower rates. The straight trendline represents the results of the regression.  $R^2$  for the smoothed model of 0.54 with no offset and 0.67 with the offset is very similar to the previous results of 0.57 and 0.69.

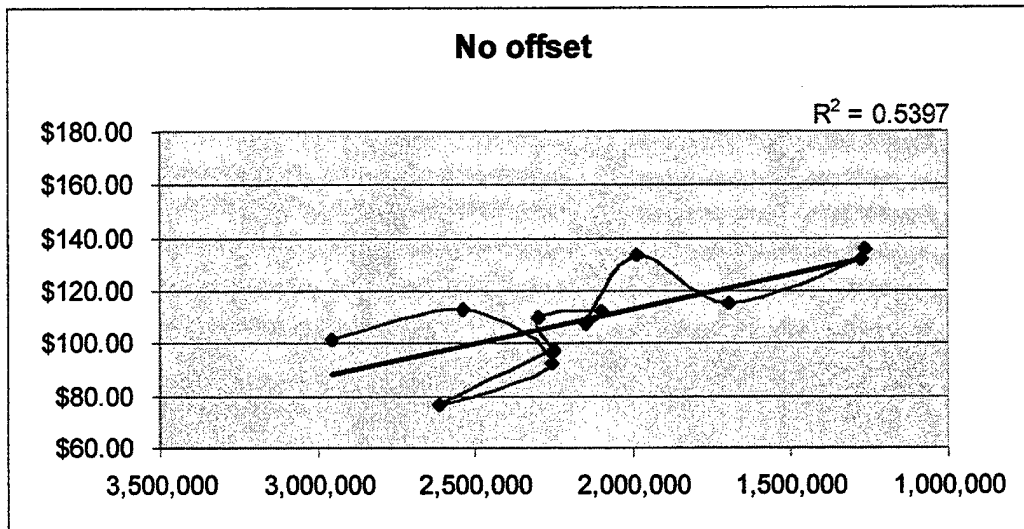


Figure 9. Regression Results Using Smoothed Total Volume and No Offset.

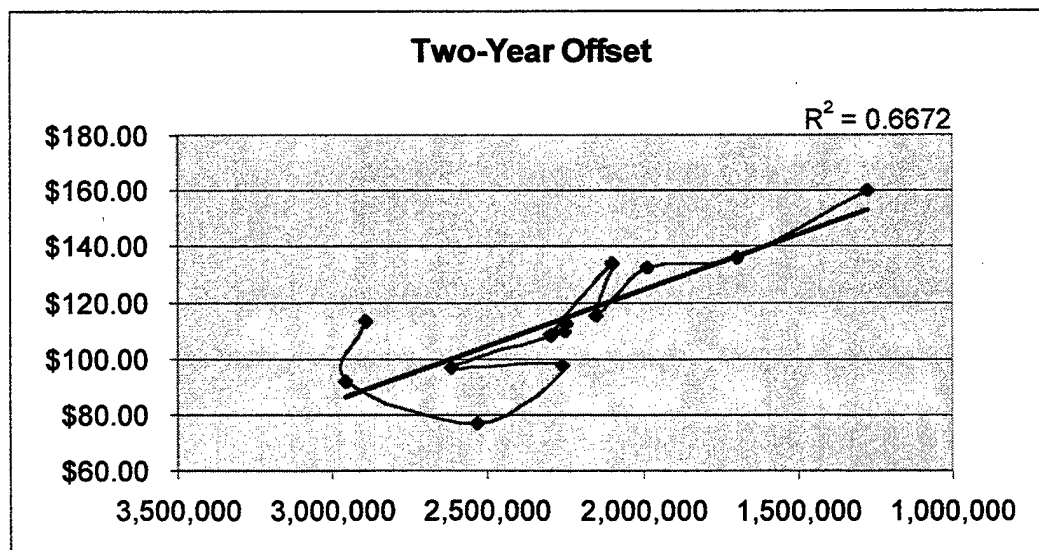


Figure 10. Regression Results Using Smoothed Total Volume and Two-Year Offset.

Given more customers sharing costs at a rate calculated for fewer customers, one would expect that increased volume would lead to unexpected gains in 1991 and lower rates in the following years<sup>25</sup>. However, Desert Storm represents a more complex phenomenon in that gains could only be expected on the part of the MSC infrastructure that is in regular service, not on the additional ships which were hired or activated to meet contingency requirements. In fact, rates held steady and even declined slightly on some routes in 1991, 1992 and 1993. This smoothed model shows that the additional Desert Storm volume distorted expected results. In the first two models, the effect of volume on a year to year basis was not statistically significant, whereas in this model, the relationship is significant.

---

<sup>25</sup> See Chapter III, Section F.

## **V. CONCLUSIONS AND RECOMMENDATIONS**

Analysis of rates and volume highlights some of the unique characteristics of sealift transportation in the Working Capital Fund context. These characteristics can be categorized generally as having to do with either flexibility for Military Sealift Command in meeting the needs of the customer or stability in rates.

### **A. CONCLUSIONS AND RECOMMENDATIONS**

#### **1. Conclusion: Rates behaved predictably during the drawdown.**

As expected, the relationship between overall decreasing trend in volume and increasing trend in rates is statistically significant for the time period from 1985 to 1997. Looking at the average annual percentage changes in rates from 1993 through 1999, when changes ranged from two percent to 19 percent to -53 percent (see Figure 4), "predictable" would not appear to be the case. However, further analysis of individual rates showed that decreases in the late 1980's and increases throughout the ninety's were related to the changing pattern in volume.

Interpreting DoD's stabilized rate policy in terms of stability and flexibility depends on the time frame in question. Rates are stable for the duration of the fiscal year in which they are set. MSC has the flexibility to continue operations even if costs are higher than expected in a given fiscal year. However, over the term of two or three years, MSC has little flexibility to smooth out drastic changes in rates such as that in 1999. Over the long term, rates again exhibit more stable patterns.

**2. Recommendation: Watch rates in the coming years for a stabilizing pattern.**

As volume stabilizes around 1.2 million measurement-tons, one of two possible patterns will likely emerge. One would be an exponential increase in rates, and the other would be slight increases in rate at something less than the current trend in increases. Exponential increases would imply that providing service on point-to-point terms was not cost effective. If point-to-point rates become unreasonable, MSC has other billing options, such as per diem rates or percentages thereof.

**3. Recommendation: Do not eliminate point-to-point billing.**

MSC is already considering eliminating point-to-point rates, for two reasons. First, if more than one type of rate is appropriate for a particular shipment, the point-to-point rate tends to be higher. Second, point-to-point rates represent a declining proportion of MSC business, especially with the removal of the American Condor and American Falcon from MSC service. Despite the fact that MSC has the flexibility to eliminate point-to-point rates, no other rate is practical in some situations, such as when one ship stops at several ports with cargo for several customers.

**B. RECOMMENDATION FOR FURTHER STUDY: HOW MSC RATES COMPARE TO COMMERCIAL SECTOR RATES**

The two Government Accounting Office reports referred to in the literature review addressed the issue of U.S. Transportation Command rates being higher than what the commercial sector would charge for similar services [Refs. 8 and 9]. Some of the issues behind this comparison that could warrant further study are 1) whether the rates negotiated between the government and the private sector carriers are reasonable and 2)

what readiness costs are factored into peacetime rates and whether such costs should be funded in some other manner.





# APPENDIX A. DATA TABLE FOR VOLUME

|             | Total      | Organic    | %   | JTMO      | %   |
|-------------|------------|------------|-----|-----------|-----|
| <b>1997</b> | 5,882,169  | 1,262,014  | 21% | 4,620,155 | 79% |
| <b>1996</b> | 6,163,266  | 1,273,594  | 21% | 4,889,672 | 79% |
| <b>1995</b> | 7,149,009  | 1,695,861  | 24% | 5,453,148 | 76% |
| <b>1994</b> | 7,531,899  | 1,987,634  | 26% | 5,544,265 | 74% |
| <b>1993</b> | 8,783,057  | 2,608,043  | 30% | 6,175,014 | 70% |
| <b>1992</b> | 10,537,133 | 3,140,648  | 30% | 7,396,485 | 70% |
| <b>1991</b> | 22,145,546 | 12,484,575 | 56% | 9,660,971 | 44% |
| <b>1990</b> | 11,180,149 | 4,034,752  | 36% | 7,145,397 | 64% |
| <b>1989</b> | 9,655,313  | 2,251,861  | 23% | 7,403,452 | 77% |
| <b>1988</b> | 9,783,673  | 2,617,105  | 27% | 7,166,568 | 73% |
| <b>1987</b> | 9,338,259  | 2,257,883  | 24% | 7,080,376 | 76% |
| <b>1986</b> | 9,060,781  | 2,535,978  | 28% | 6,524,803 | 72% |
| <b>1985</b> | 9,468,570  | 2,955,751  | 31% | 6,512,819 | 69% |
| <b>1984</b> | 8,815,949  | 2,894,383  | 33% | 5,921,566 | 67% |

Table 4. Data Table for Total, Organic and JTMO Volume, 1984-1997  
[Ref. 1, 1985-1997].



# APPENDIX B. DATA TABLE FOR RATES ON SELECTED ROUTES

|      | East Coast  |              | California Coast |           |
|------|-------------|--------------|------------------|-----------|
|      | East Coast- |              | Cal. Coast-      |           |
|      | Europe      | Arabian Gulf | Arabian Gulf     | Korea     |
| 1999 | \$ 74.65    | \$ 140.55    | \$ 203.10        | \$ 92.45  |
| 1998 | \$ 160.20   | \$ 301.65    | \$ 435.85        | \$ 198.35 |
| 1997 | \$ 135.90   | \$ 255.85    | \$ 369.70        | \$ 168.25 |
| 1996 | \$ 132.35   | \$ 248.85    | \$ 370.45        | \$ 168.55 |
| 1995 | \$ 115.10   | \$ 225.25    | \$ 319.95        | \$ 149.65 |
| 1994 | \$ 133.65   | \$ 258.15    | \$ 356.80        | \$ 161.00 |
| 1993 | \$ 108.05   | \$ 188.15    | \$ 271.75        | \$ 130.45 |
| 1992 | \$ 112.60   | \$ 196.10    | \$ 283.20        | \$ 135.95 |
| 1991 | \$ 110.05   | \$ 176.50    | \$ 274.30        | \$ 125.95 |
| 1990 | \$ 97.20    | \$ 149.85    | \$ 211.15        | \$ 116.65 |
| 1989 | \$ 97.85    | \$ 147.95    | \$ 202.50        | \$ 112.55 |
| 1988 | \$ 76.95    | \$ 123.40    | \$ 174.70        | \$ 91.65  |
| 1987 | \$ 92.30    | \$ 136.75    | \$ 196.55        | \$ 109.95 |
| 1986 | \$ 113.35   | \$ 175.30    | \$ 259.10        | \$ 135.35 |
| 1985 | \$ 101.85   | \$ 133.75    | \$ 169.55        | \$ 114.30 |

Table 5. Data Table for Rates on Selected Routes [Refs. 11 &12].



## LIST OF REFERENCES

1. *Year in Review: Annual Reports of the Military Sealift Command*, (Washington, D.C.: Military Sealift Command, 1985-1997).
2. Matthews, James K. and Holt, Cora J., *So Many, So Much, So Far, So Fast: United States Transportation Command and Strategic Deployment for Operation Desert Shield/Desert Storm*, (Joint History Office, Office of the Chairman of the Joint Chiefs of Staff and Research Office, United States Transportation Command, 1992).
3. *FY 2000/2001 Budget Estimation Submission: Budget Narrative for the MSC Transportation Business Area*, prepared by the Military Sealift Command for submission to the Office of the Secretary of Defense, September 1998.
4. *Understanding the Defense Transportation System*, USTRANSCOM Handbook 24-2, (Scott AFB, IL: USTRANSCOM/TCJ5-SP, 1997).
5. Branch, Alan E., *Elements of Shipping*, 7<sup>th</sup> ed., (London: Chapman & Hall, 1996).
6. *Department of Defense Financial Management Regulation*, vol. 2B, ch. 9: Defense Working Capital Funds: Activity Group Analysis, and vol. 11B, ch. 50: Reimbursable Operations, Policy and Procedures—Working Capital Funds (WCF), (Washington D.C.: Office of the Under Secretary of Defense (Comptroller), 1994). Available from [[www.dtic.mil/comptroller/fmr/](http://www.dtic.mil/comptroller/fmr/)].
7. *Chief Financial Officer Annual Financial Statements FY 1997*, Department of the Navy, Navy Working Capital Fund, and U.S. Transportation Command Working Capital Fund, available from the Office of the Under Secretary of Defense (Comptroller) homepage at [[www.dtic.mil/comptroller/97afs/](http://www.dtic.mil/comptroller/97afs/)] Accessed 10 March 1999.
8. Government Accounting Office, *Status of U.S. Transportation Command Savings Initiatives*, Report to the Chairman, Subcommittee on Military Readiness, Committee on National Security, House of Representatives, GAO/NSIAD-98-99, May 1998.
9. Government Accounting Office, *Defense Transportation: Streamlining of the U.S. Transportation Command is Needed*, Report to the Chairman, Subcommittee on Military Readiness, Committee on National Security, House of Representatives, GAO/NSIAD-96-60, February 1996.
10. Grace, Al, Sealift Analyst for Military Sealift Command, telephone interview by author, 18 November 1998.
11. *Billing Rates*, COMSC Instruction 7600.3J, with annual changes 1-6 for 1993 through 1998, (Washington D.C.: Commander, Military Sealift Command, 1992).

12. Flegal, Joel, Budget Analyst for Military Sealift Command, interview by author, Washington, D.C., 8 January 1999.
13. *Standard Characteristics for Transportability of Military Vehicles*, v.1.2b, TB 55-46-1 on CD-ROM, (Newport News, Va., Military Traffic Management Command Transportation Engineering Agency, 1999).
14. *Logistics Handbook for Strategic Mobility Planning*, MTMCTEA Reference 94-700-2, (Newport News, Va.: Military Traffic Management Command Transportation Engineering Agency, 1994).
15. Hume, Griff, Business Manager for Military Sealift Command Sealift Program Office, interview by author, Washington D.C., 7 January 1999.

## INITIAL DISTRIBUTION LIST

1. Defense Technical Information Center .....2  
8725 John J. Kingman Road, Ste 0944  
Fort Belvoir, VA 22060-6218
  
2. Dudley Knox Library .....2  
Naval Postgraduate School  
411 Dyer Road  
Monterey, CA 93943-5101
  
3. Defense Logistics Studies Information Exchange ..... 1  
U.S. Army Logistics Management College  
Fort Lee, VA 23801-6043
  
4. Military Sealift Command ..... 3  
Code N35X (Chris Thayer)  
Code PM5 (Griff Hume)  
Code N8 (Joel Flegal)  
Washington Navy Yard  
914 Charles Morris Ct. SE  
Washington, D.C. 20398-5540
  
5. U.S. Transportation Command ..... 1  
Code TCJ5-AS (COL Thomas Shea)  
508 Scott Drive  
Scott AFB, IL 62225-5357
  
6. Professor Ira A. Lewis (Code SM/LE) ..... 1  
Naval Postgraduate School  
Monterey, CA 93943
  
7. CDR Ted Hleba (Code SM/HB) ..... 1  
Naval Postgraduate School  
Monterey, CA 93943
  
8. Angela H. Hively.....1  
1522 Stafford Ave.  
Merritt Island, FL 32952